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One year of Seaglider dissolved oxygen concentration profiles at the PAP site

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Oxygen is one of the most important variables measured in oceanography, influenced both by physical and biological factors. During the OSMOSIS project, 7 Seagliders were used in 3 subsequent missions to measure a multidisciplinary suite of parameters at high frequency in the top 1000 m of the water column for one year, from September 2012 to September 2013. The gliders were deployed at the PAP time series station (nominally at 49° N 16.5° W) and surveyed the area following a butterfly-shaped path. Oxygen concentration was measured by Aanderaa optodes and calibrated using ship CTD O_2 profiles during 5 deployment and recovery cruises, which were in turn calibrated by Winkler titration of discrete samples.

The oxygen-rich mixed layer deepens in fall and winter and gets richer in oxygen when the temperature decreases. The spring bloom did not happen as expected, but instead the presence of a series of small blooms was measured throughout spring and early summer. During the summer the mixed layer become very shallow and oxygen concentrations decreased.

A Deep Oxygen Maximum (DOM) developed along with a deep chlorophyll maximum during the summer and was located just below the mixed layer . At this depth, phytoplankton had favourable light and nutrient conditions to grow and produce oxygen, which was not subject to immediate outgassing. The oxygen concentration in the DOM was not constant, but decreased, then increased again until the end of the mission.

Intrusions of oxygen rich water are also visible throughout the mission. These are probably due to mesoscale events through the horizontal transport of oxygen and/or nutrients that can enhance productivity, particularly at the edge of the fronts.

We calculate net community production (NCP) by analysing the variation in oxygen with time. Two methods have been proposed. The classical oxygen budget method assumes that changes in oxygen are due to the sum of air-sea flux, isopycnal advection, diapycnal mixing and NCP. ERA-Interim provides climatological data to calculate air-sea gas exchange fluxes based on wind-speed parameterisations of the gas exchange coefficient. The second method exploits the high frequency of the measurements to determine the increment of oxygen over time during daylight hours to measure NCP. Together with the O_2 concentration decrease during the night (due to community respiration), this method also allows us to derive gross oxygen production rates. The results of these two methods are compared.